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湖南常桃盆地北柱兽类化石及相关地层问题[1)]

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摘要 记述了在湖南省常桃盆地延泉剖面上发现的北柱兽类一新属新种——湖南窄柱兽(*Stenostylops xiangensis* gen. et sp. nov.)。新属以其长大于宽的窄长的上颊齿区别于北柱兽类任何已知属。新记述的种类表明含化石层的地质时代为早始新世或可能稍早。

关键词 湖南常桃盆地,早始新世,北柱兽类

中图法分类号 Q915.873

1976 年,原湖南省石油地质普查勘探大队(简称湖南石油队)胡济民等同志在湖南北部常桃盆地桃源县延泉剖面上发现了恐龙蛋,三年后做了研究(曾德敏等,1979)。他们并把同时采到的哺乳动物化石交予中国科学院古脊椎动物与古人类研究所鉴定。由于多种原因,标本鉴定后研究工作一直未能进行。最近笔者有机会观察和研究此标本,认为是北柱兽类的一个新属新种。此化石的发现,无论在生物学上还是在地层学上都有一定的意义。

1 标本记述

北柱兽目 Arctostylopida Cifelli, Schaff and McKenna, 1989

北柱兽科 Arctostylopidae Schlosser, 1923

窄柱兽(新属) *Stenostylops* gen. nov.

特征 同属型种特征。

属型种 湖南窄柱兽(*Stenostylops xiangensis* gen. et sp. nov.)。

包括种 仅一属型种。

湖南窄柱兽(新属新种) *Stenostylops xiangensis* gen. et sp. nov.

(图版 I;图 1)

正型标本 一左上齿列 P3～M3(V 12434)。

产地及层位 湖南省桃源县延泉一带,早始新世剪家溪组。

特征 上颊齿 P3～M3 外壁长而平,外脊直,牙齿长大于宽。P3～P4 前附尖特别发

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育。上臼齿后壁中部收缩明显。M1～M2 后齿带发育，形状近梯形，无次尖。

词义　Stenos，(希)狭窄的，stylops 柱兽动物。意即上颊齿外壁长、牙齿相当窄长的一类北柱兽。xiang，湘，湖南省的简称，即化石产地所在省。

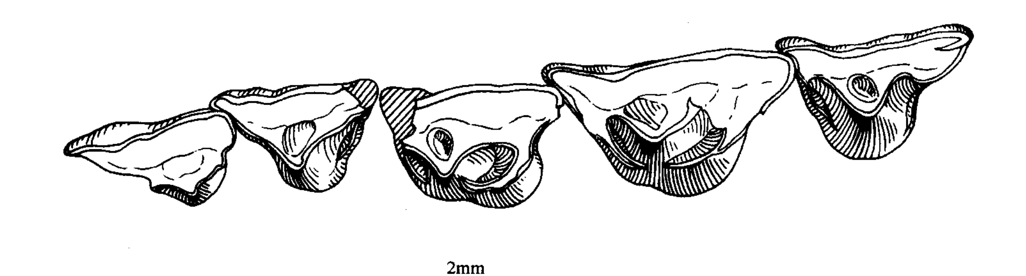


图1　湖南窄柱兽(新属新种)的上颊齿P3～M3(V 12434)(冠面观)

Fig.1　Upper cheek teeth P3～M3(V 12434) of *Stenostylops xiangensis* gen. et sp. nov. (Crown view)

描述　上颊齿 P3～M3 前、后附尖发育，外壁长而平，外脊长而直，其上的前尖和后尖难以辨认。这些牙齿长均大于宽(表 1)。无外齿带。P3 呈斜三角形，外壁最长，前内壁次之，后内壁长略大于外壁之半。前附尖叶很发育，向前突出明显。外脊上的尖比起其他牙齿还算隐约可辨。原尖较大，位置靠后，呈 V 形，原尖前脊和原尖后脊在接近外脊处弱而不清楚。无外齿带和前内齿带，后内齿带也不明显。P4 后附尖处稍破损，虽也呈斜三角形，但牙齿比 P3 宽。由于磨蚀比 P3 轻，原尖比在 P3 中位置高。原尖 V 形，夹角略大于 60°。原尖前脊和原尖后脊明显，似分别伸向前尖和后附尖基部，与外脊围成较深的三角凹。原尖前脊较直，原尖后脊在向外伸至 2/3 处折向牙齿后外角，因此牙齿后壁中部显得有收缩现象。与 P3 不同还在于有发育轻微的比较低的(内低外高)后齿带。

表 1　湖南窄柱兽(新属新种)的上颊齿(V 12434)测量

Table 1　Measurements of upper cheek teeth (V 12434) of *Stenostylops xiangensis* gen. et sp. nov.　(mm)

牙齿(tooth)	P3	P4	M1	M2	M3
长(length)	3.1	3.2	3.7*	4.8	3.9
宽(width)**	1.8	2.1	2.4	3.0	2.5

* 近似值。** 外壁最外两点的连接线与牙齿最内端之间的垂直宽度。

上臼齿无次尖。M1 前尖和前附尖处破损。由于后齿带发育，牙齿呈以外壁为底内壁为顶之梯形。齿冠内侧有一轻微浅沟。由于牙齿磨蚀较深，原尖前脊和原尖后脊与外脊相接处已不清楚。牙齿前内角有较低的齿带。后齿带十分发育，位置高，形成明显的次尖架。牙齿的后内角浑圆，其靠内程度与原尖相近。后齿带与原尖后脊之间有深坑。牙齿后壁中部明显向前收缩呈月牙状。M2 保存完好，比 M1 大得多(表 1)，形态似 M1，只内侧浅沟极不明显。原尖正外方外壁微微向内收缩，但外脊仍相当平直。前齿带低弱，后齿带虽不如在 M1 中发育但仍很强大，它们同样在原尖内侧不相连。M3 呈斜三角形，后壁长于前壁。外壁中前部微微向内凹入。前、后齿带均很低弱，且在原尖内侧(稍破损)中断。后壁中部向前收缩比前两牙齿更显。

表 2 湖南窄柱兽(新属新种)的上齿列(V 12434)测量

Table 2 Measurements of upper tooth row (V 12434) of *Stenostylops xiangensis* gen. et sp. nov. (mm)

P3～M3	P3～M2	P3～M1	P3～P4	P4～M3	P4～M2	P4～M1	M1～M3	M1～M2	M2～M3
17.5	14.0	9.5	6.0	14.5	11.2	6.7	11.5*	7.8	8.2

* 近似值。

比较与讨论 目前已发现的北柱兽类化石分布在北美和亚洲，计有 9 属 11 个种(表 3)。它们之中，除 *Sinostylops promissus* (汤英俊等，1976)、*Bothriostylops notios*(郑家坚等，1986)和 *Kazachostylops occidentalis* (Nesov, 1987) 3 种无上颊齿而无法直接对比外，湖南窄柱兽与其他具上颊齿各种均有很大的区别。北美的 *Arctostylops steini*, M1 和 M2 呈方形，舌面有沟槽分开原尖和次尖(Matthew, 1915; Cifelli et al., 1989)。而湖南窄柱兽的 M1 和 M2 呈梯形，内壁纵沟弱或无，更无次尖发育。湖南窄柱兽的 M2 虽比前后两个臼齿大，但增大程度远不如在 *Palaeostylops* 属中的两个种显著(Matthew and Granger, 1925; Matthew et al., 1929)。后者 M1 和 M2 具与原尖明显分开的次尖，前者则无。湖南窄柱兽与 *Asiostylops spanios*(郑家坚，1979)的区别在于 M1 和 M2 不呈三角形而为梯形，有十分发育的后齿带。江西池江盆地发现的另一种北柱兽(*Allostylops periconatus* 的 P4 臼齿化程度高，前面两个上臼齿呈方形，有发育的围尖，齿冠外壁在前尖和前附尖之间有深的纵沟(郑家坚，1979)，均与湖南窄柱兽不同。*Bothriostylops progressus* 的 M2 外壁在前尖和前附尖之间有深沟(汤英俊等，1976)，后齿带也不如在湖南窄柱兽中发育。*Wanostylops youngi* 的 M1 和 M2 内侧有较深的纵沟，并有两个明显尖状齿带突起(黄学诗

表 3 北柱兽类化石的地史地理分布

Table 3 Geologic and geographic distribution of Arctostylopida

Species	Age	Horizon	Distribution
Arctostylops steini	Late Paleocene; Eocene?	Tiffanian to Late Clarkforkian; Wasatchian?	North America
Palaeostylops iturus	Late Paleocene	Gashato Fm, Naran Bulak Fm, Nomogen Fm, Shuangtasi Fm	Mongolia; China
*Palaeostylops macrodon**	Late Paleocene	Gashato Fm, Naran Bulak Fm, Nomogen Fm	Mongolia; China
Sinostylops promissus	Late Paleocene	Doumu Fm	Anhui, China
Bothriostylops notios	Late Paleocene	Chijiang Fm	Jiangxi, China
Bothriostylops progressus	Late Paleocene	Shuangtasi Fm	Anhui, China
Asiostylops spanios	Late Paleocene	Chijiang Fm	Jiangxi, China
Allostylops periconatus	Late Paleocene	Chijian Fm	Jiangxi, China
Wanostylops youngi	Late Paleocene	Shuangtasi Fm	Anhui, China
Kazachostylops occidentalis	Late Paleocene		Kazakhstan
Anatolostylops dubius	Early Eocene	Shisanjianfang Fm	Xinjiang, China

* *Gashatostylops macrodon* Cifelli et al., 1989 = *Palaeostylops macrodon* Matthew et al., 1929 (Huang and Zheng, 1997).

等,1997),与湖南窄柱兽显然有较大的差别。湖南窄柱兽和 *Anatolostylops dubius*(翟人杰,1978)倒有许多相似之处。它们的 M2 均呈梯形,外脊长、平滑,尖的痕迹在脊上表现得不清楚。前附尖大但无前尖肋。原尖前脊和原尖后脊在冠面上围成显著的三角凹,且齿冠外侧以及原尖处的内侧都无齿带发育。但这两种动物之间的区别也是明显的。湖南窄柱兽牙齿比 *Anatolostylops dubius* 小,前者 M2 长 4.8mm,宽 3.0mm,M2~M3 长 8.4mm(表 1 和表 2);而后者 M2 长宽分别是 6.5 和 5.4mm,M2~M3 长 11.0mm(翟人杰,1978)。后者 M2 在舌面有垂直沟而前者无或弱。前者 M3 长宽分别是 3.9 和 2.5mm(表 1),而后者是 4.9 和 5.1mm(翟人杰,1978)。此外,湖南窄柱兽的齿冠也不如 *Anatolostylops dubius* 高。除了与上述种各自不同外,湖南窄柱兽长的外壁和外脊、上颊齿长比宽大得多、后壁中部收缩呈月牙形等特点不同于包括疑东方柱兽在内的所有已知的北柱兽种类。因此它可能是至今还没记述过的一类新的北柱兽,本文命名它为湖南窄柱兽(*Stenostylops xiangensis* gen. et sp. nov.)。

附记 储澄(1986)记述的延泉剖面中第 24 层的牙齿化石,齿冠上端略尖,前外侧面突,后内侧面较平,有一粗大且稍弯曲的长齿根,比较大,齿冠长、宽、高分别为 9.2、6.4 和 10.5mm,显然是一门齿,很可能为有蹄类的门齿(V 12435)。同时发现的还有一哺乳动物的枢椎(V 12436),其横突部分特别是左侧已破损。椎体背侧较粗糙,无棘突发育。后端关节窝椭圆形,横径较大,微凸。此枢椎相当大。椎体长、宽、高分别为 35、66 和 33mm。齿突横切面椭圆形,前端较尖,长约 23mm,最大径(左右)约 21mm。

2 湖南窄柱兽的地质时代

常桃盆地内有发育良好的晚白垩世和古近纪红色地层,但由于露头掩覆、地质构造复杂,两个时代地层间的界线不很清楚。储澄(1986)在描述桃源县延泉剖面时,将上白垩统岩码头组自下而上分为 28 层,其中 8、22、23 和 25 层均含有恐龙蛋,而第21 层产北柱兽类化石,24 层中也有哺乳动物牙齿。也就是说在剖面上北柱兽化石以上尚有三层产“恐龙蛋化石”。成窝或完整的恐龙蛋化石均产自剖面的 8 层,这些蛋化石经曾德敏等(1979)研究,计有湖南丛状蛋(*Phaceloolithus hunanensis*)、大长形蛋(*Elongatoolithus magnus*)和长形蛋未定种(*Elongatoolithus* sp.)。其中的大长形蛋与山东莱阳晚白垩世王氏群上部、广东南雄南雄组和河南淅川的胡岗组中发现的长形蛋相似。同层中的介形类和轮藻等微体动物化石也与南雄组中的相近,因此时代属晚白垩世无疑。本文记述的产于第 24 层可能是有蹄类的门齿,特别是大的哺乳动物枢椎,虽然它们不能对确定详细的地层时代有所帮助,但这样的哺乳类在始新世以前的地层里还未曾见过,当然更不可能是中生代的。北柱兽类在世界上共发现过 9 属 11 种,其中大部分在我国。其地质时代多为晚古新世,仅疑东方柱兽为早始新世或稍晚,斯氏北柱兽从晚古新世可能延到早始新世(表 3)。湖南窄柱兽在特征上很类似疑东方柱兽,其时代似应为早始新世。但由于湖南窄柱兽是一类奇特的动物,它的上颊齿外脊特别长,长宽相比相差甚远,目前还弄不清楚这样的特点是原始还是进步,加上个体比疑东方柱兽小,齿冠也不那么高,因此,不排除有时代较早的可能,但这有待今后发现新的材料才能证实。

此外,据资料记述,在延泉剖面也曾发现过狉类(可能类似于宽臼兽科 Eurymylidae)

的零星化石(可惜文革期间标本已丢失)。同样,它也曾见于澧县钻孔中(郑家坚等,1979;李云通等,1984),其时代也为早始新世,这为湖南窄柱兽的时代提供了佐证。

上述分析表明,1)在常桃盆地及其附近确有早始新世地层存在;2)在延泉剖面含窄柱兽21层之上不可能有含真正恐龙蛋的层位。

3 相关地层问题的讨论

常桃盆地的红层尽管较为发育,但系统性综合性的研究很少,因此涉及地层的划分、命名和时代等各家认识很不一致,这里仅讨论如下两个有关问题。

3.1 晚白垩世"岩码头组"的质疑

"岩码头组"由前中南石油地质大队胡济民等于1983年建立,其命名剖面位于桃源县延泉、岩码头一带。该组厘定的含义为位于晚白垩世分水坳组(狭义)之上的一套砖红、棕红色含砾砂岩、泥质砂岩、细砂岩和砂质泥岩、泥岩等组成的层位,夹有砂砾岩和细砾岩的透镜体。它大致相当于原湖南石油队1962年划分的分水坳组的第三段。胡济民等认为"岩码头组"与上覆古近系为整合接触,时代为晚白垩世;命名剖面自下而上分为28层(见储澄,1986)。

根据前人有关文献的记述和分析,"岩码头组"作为独立的地层单位存在不少问题。早在1973~1980年期间,"岩码头组"不同层位中已发现微体古生物和若干重要的脊椎动物化石。这些重要的材料并没有引起原命名者的足够重视。从化石产出层位分析,其中较完整的恐龙蛋主要见于上述剖面层8,这些化石经曾德敏等(1979)研究,计有湖南丛状蛋 *Phaceloolithus hunanensis*、大长形蛋 *Elongatoolithus magnus* 和长形蛋未定种 *Elongatoolithus* sp. 三种,时代无疑为晚白垩世。而本文记述的古近纪窄柱兽发现于层21。问题产生在层21之上的层22、23和25又出现了恐龙蛋碎片(储澄等认为是长形蛋未定种),而层24又有古近纪大型哺乳类的枢椎和有蹄类门齿的发现。这一"层序颠倒"的现象使人不得其解。有人却简单地认为"岩码头组"发现的恐龙蛋与哺乳动物化石是混生的,并依恐龙蛋的地史分布,定时代为晚白垩世。这样的结论显然是不合理的。北柱兽目在世界上发现过9属11种(表3),它主要分布在晚古新世~早始新世,尚未发现有任何晚白垩世的种类。窄柱兽与北柱兽类有关种类相比,它更接近晚期的类型。其次,值得注意的是层22、23和25出现的蛋化石,这些至关重要的材料至今未见有任何采集的实物,更未有人予以显微结构或形态的研究,不知如何被鉴定为长形蛋未定种。是否有可能不是恐龙蛋,而是其他爬行动物(龟鳖类、鳄类)或鸟类的蛋化石。再者,如确是恐龙蛋的碎片,那么这些碎片是原生埋藏的,还是侵蚀搬运后次生沉积的。后者情况在我国古近纪红层的底部层位中时有所见。当然,也不排斥该地区地质构造复杂,剖面地层层序有误的可能。因为层24中发现的哺乳动物化石,虽材料少,但仍能说明其时代不可能是中生代。此外,在相当于"岩码头组"上部层位中还曾发现过类似于早始新世哺乳动物狉类化石。上述讨论和分析足以说明"岩码头组"上部不是晚白垩世的沉积。从命名剖面记述看,笔者认为中、新生代的界线可能位于层8与层9之间,而不是原命名者认为的层28之上。显然其间有沉积间断,缺失古新统沉积。至于"岩码头组"下部层位(包括层8及其下),从已发现的

化石看与下伏分水坳组(狭义)较为相似，难以区别，看不出时代有早晚之分。

综上所述，“岩码头组”建组条件很不成熟。根据地层多重划分和命名优先的准则，笔者赞同湖南省地质矿产局地层清理小组(1997)的建议，弃用该名。

3.2 古近纪红层命名的取舍

常桃盆地古近纪红层最早由原湖南石油队于 1962 年命名为剪家溪组，之后该名一直被使用，但其时代有所争议，有人认为是古新世，也有人认为是始新世。1974～1978 年间原湖南石油队又在同一地区建立沅江组，1980～1986 年间前中南石油队和储澄等建立和使用古新世桃源组来代替原有的命名。由于命名更换，创建新名又无详细说明，以致在地层对比和区域综合研究上造成很大的困难和混乱。笔者认为建立任何新的地层单位名称都必须符合中国地层指南有关原则，并在公开发行刊物上予以详细说明，否则该名难以成立。如果地层单位名称建立后不能说明它的时空分布特点和地层位置相对关系，那么这种命名很难求得实效。从上述各方面因素考虑，我们认为最早命名的剪家溪组这一单位名称是有效的，建议应该保留。至于其后分别建立的其他单位名称，因其厘定的含义与剪家溪组无多大的变化，也不规范，可视为后者的同物异名，应予废除。

最近有些学者建议以湘东南茶陵盆地古新世枣市组来代替剪家溪组等名，并将其含义扩大到包括晚白垩世晚期沉积。这种看法有待商榷。首先以华南广泛分布的红层为例，它们并不具有相同的地层位置，各个盆地的沉积发育史也不同。另外，影响盆地沉积性质的因素也是多方面的，如古气候、环境、生物界、地质构造、母岩成分等等，它远比海相沉积复杂得多。很难设想能用一种简单的单一模式来解释陆相沉积的时空分布的特点。上面提到的枣市组是亚洲具有一定代表性的层位，命名地点层型界线清楚。原厘定的含义只包括中古新世沉积。剪家溪组无论从岩相还是从生物群特点看都与枣市组不相似，也不具有相同的地层位置。因此没有理由将两个不同特征的地层单位名称合二为一。笔者认为用枣市组一名来代替剪家溪组显然是不适宜的。

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ARCTOSTYLOPID FOSSIL (MAMMALIA) OF CHANGTAO BASIN, HUNAN AND COMMENTS ON RELATED STRATIGRAPHY

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Key words Changtao Basin, Hunan, Early Eocene, arctostylopid

Summary

The present paper deals with a new arctostylopid, *Stenostylops xiangensis* gen. et sp. nov., which was found in Changtao Basin, Hunan Province by local geologists in 1970's. The new form sheds light on the age of fossil-bearing bed.

1 Paleontology

Arctostylopida Cifelli, Schaff and McKenna, 1989

Arctostylopidae Schlosser, 1923

***Stenostylops* gen. nov.**

Diagnosis As for the genotype.

Type species *Stenostylops xiangensis* gen. et sp. nov.

Included species Type species only.

Etymology steno, means the upper cheek teeth are narrow and long; stylops, arctostylopid animal.

***Stenostylops xiangensis* gen. et sp. nov.**

Type Upper cheek teeth P3~M3(V 12434).

Locality and horizon Nearby Yanquan, Taoyuan County, Hunan Province; Early Eocene Jianjiaxi Formation.

Diagnosis Upper cheek teeth longer than wide. External wall and ectoloph long and flat. Parastyle rather developed on P3~ P4. Middle part of posterior margin distinctly contracted forward on upper molars. M1 and M2 trapezoid in outline with rather developed posterior cingulum but no hypocone.

Etymology xiang, short word for Hunan Province, where fossil was yielded.

Description The external wall is long and flat, and ectoloph is long and staight on P3~ M3. All cheek teeth described are longer than wide (table 1), and have no external cingulum. P3 is oblique triangular in outline with external wall as longest and the posterointernal one shortest. Parastyle lobe rather developed, distinctly project anteriorly. Protocone is large, V-shaped, and posteriorly situated on the tooth crown.

There are no external and anterointernal cingula. The posterointernal cingulum is indistinct. P4, damaged at posteroexternal corner, is also oblique triangular in shape, but wider than P3. Protocone is high in position owing to little wear. Pre- and post-protolophs are distinct, extending to the base of paracone and metastyle, respectively, and together with ectoloph forming a close trigon basin. The posterior wall contracted forward in the middle. The posterior cingulum is lower and weak.

There is no hypocone on the upper molars. M1 is trapezoid in outline (broken at anteroexternal corner). The anterointernal cingulum is lower and weak, but posterior cingulum is high and strong, forming hypocone-shelf, and as internally situated as the protocone. There is deep pit between the postprotoloph and hypocone-shelf. The middle part of the posterior wall contracted forward somewhat like lunar. M2 is in good preservation, bigger than M1. It is trapezoid in shape as M1. The anterior cingulum is lower and weak. The posterior cingulum is still very developed though not as strong as in M1, and disconnected with the anterior one on the inner side of the protocone, like in M1. M3 is oblique triangular in outline, with posterior wall longer than the anterior one. Both anterior and posterior cingula are very lower and weak, and disconnected at the inner side of the protocone. The posterior wall contracted more distinct than in the first two molars.

Comparison 9 genera and 11 species of Arctostylopida have been found in the world. Among these *Sinostylops promissus*, *Bothriostylops notios* and *Kazachostylops occidentalis* have no upper dentition been found so far, so it is very difficult to compare them with our specimen directly. North American *Arctostylops steini* possesses quadrate M1 and M2 with hypocone, whereas M1 and M2 of *Stenostylops xiangensis* are trapezoid in outline and have no hypocone. M2 of *Stenostylops xiangensis* is not as enlarged as that in the two species of *Palaeostylops* (*P. iturus* and *P. macrodon*) though it is still much bigger than the other two upper molars. M1 and M2 of *Palaeostylops* are quadrate in shape with distinct hypocone while these two teeth are trapezoid in outline and without hypocone in the former. *Stenostylops xiangensis* differs from *Asiostylops spanios* in having trapezoid M1 and M2 with very developed posterior cingulum. *Allostylops periconatus* in the same basin with *Asiostylops spanios* has more molariform P4, and quadrate M1 and M2 with pericone, the situation is not like that in *Stenostylops xiangensis*. Deep groove between parastyle and paracone on the external wall and lesser developed posterior cingulum of M2 in *Bothriostylops progressus* are different features from *Stenostylops xiangensis*. *Wanostylops youngi* differs from *Stenostylops xiangensis* in having distinct vertical groove and cusp-like cingulum on the inner side of the first two molars. There are indeed some similarities between *Stenostylops xiangensis* and *Anatolostylops dubius*. For instance, M2 of both forms is trapezoid in outline, with long and flat external wall and ectoloph but no hypocone, having big parastyle but no parastyle or paracone

rib. Pre- and post-protolophs form deep close trigon basin on the crown, and no cingulum developed on the external side of the tooth and inner side of the protocone. Difference, however, is still distinct between the two. *Stenostylops xiangensis* (M2～M3 = 8.4mm) is smaller than *Anatolostylops dubius* (M2～M3 = 11.0mm). M2 has distinct vertical groove on the inner side in the latter but no such groove in the former. M3 is longer than wide in the former but wider than long in the latter. The crown height in the former is not as high as in the latter though it is not so low.

Apart from the differences mentioned above, the long and flat external wall and ectoloph of upper cheek teeth which are all longer than wide in *Stenostylops xiangensis* can distinguish the new form and other known arctostylopids.

2 Comments on stratigraphy

2.1 The age of *Stenostylops xiangensis*-bearing bed

The Late Cretaceous and Paleogene red beds are well developed in the Changtao Basin, but the boundary of sediments between the two ages is hardly distinguished. He divided the upper Cretaceous "Yanmatou Formation" into 28 beds while Chu (1986) described Yanquan Section in Taoyuan County. According to this report dinosaur eggs were in beds 8, 22, 23 and 25, arctostylopid fossil was in bed 21. That means above *Stenostylops xiangensis*-bearing bed there were three dinosaur egg-bearing beds. In fact the complete dinosaur eggs are all in bed 8, which studied by Zeng and Zhang (1979) are as follows: *Phaceloolithus hunanensis*, *Elongatoolithus magnus* and *Elongatoolithus* sp. Among these fossils *Elongatoolithus magnus* was found in Wangshi Formation, Shandong, in Nanxiong Formation, Guangdong and in Hugang Formation, Henan of upper Cretaceous. So bed 8 undoubtedly belongs to Late Cretaceous age.

The ungulate's incisor and big mammal axis vertebra in bed 24 described in the present paper were never found before Eocene in China although they are of little help in age determination. Arctostylopid fossils so far found in the world contain 9 genera and 11 species, ranging in age mainly from Late Paleocene to Early Eocene (most of them are in Late Paleocene). It is mostly similar to *Anatolostylops dubius* of Early Eocene age among all the arctostylopid species though *Stenostylops xiangensis* is a very strange animal with much longer upper cheek teeth. So the age of *S. xiangensis*-bearing bed is probably of Early Eocene, or a little earlier. We believe that in Yanquan Section above this bed there are no real dinosaur egg-bearing beds.

2.2 The valid formation's name for Paleogene sediments in Changtao Basin

In Changtao Basin there were several formation's names, such as Jianjiaxi Fm, Yanmatou Fm, Yuanjiang Fm, Taoyuan Fm and Zhaoshi Fm for the Paleogene strata in the past, but we think Jianjiaxi Formation is a valid name. The reasons for this are as follows: a) This name is the first one appeared in 1962; b) It represents real

Paleogene strata in the Basin.

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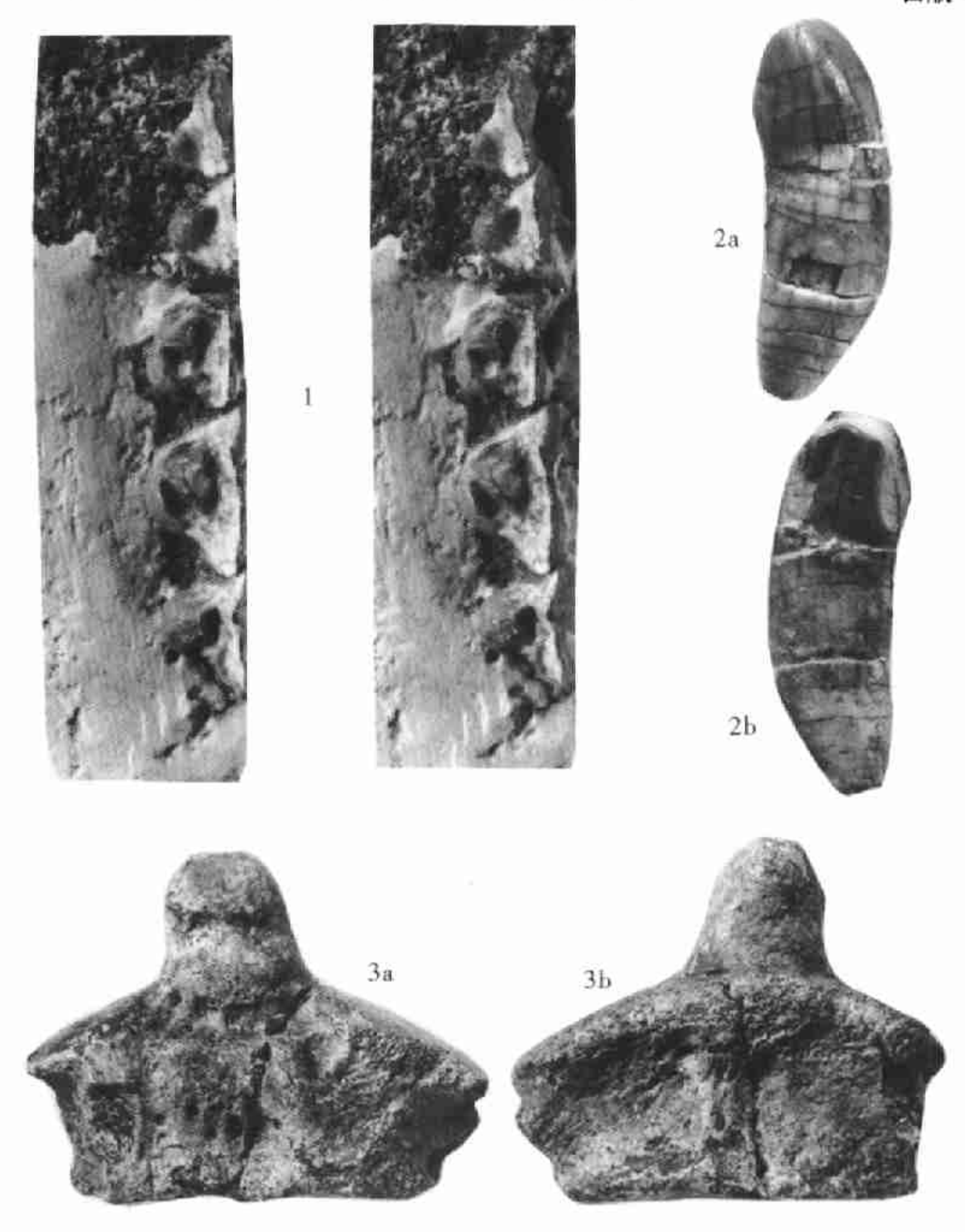
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图版Ⅰ说明(Explanations of Plate Ⅰ)

1 湖南窄柱兽(新属新种)(*Stenostylops xiangensis* gen. et sp. nov.), ×5
上颊齿 P3～M3 (V 12434) 冠面观(立体照片)(stereo-photograph of crown view)

2 有蹄类门齿(Ungulate's incisor)(V 12435), ×2, a 唇面观(Labial view); b 舌面观(Lingual view)

3 哺乳动物枢椎(Mammal's axis)(V 12346), ×1, a 背面观(Dorsal view); b 腹面观(Ventral view)


1
2a
2b
3a
3b